



## - CONTENTS -

|                                         |    |
|-----------------------------------------|----|
| REVISION HISTORY                        | 3  |
| 1. GENERAL DESCRIPTION                  | 4  |
| 1.1 OVERVIEW                            |    |
| 1.2 FEATURES                            |    |
| 1.3 APPLICATION                         |    |
| 1.4 GENERAL SPECIFICATIONS              |    |
| 1.5 MECHANICAL SPECIFICATIONS           |    |
| 2. ABSOLUTE MAXIMUM RATINGS             | 5  |
| 2.1 ABSOLUTE RATINGS OF ENVIRONMENT     |    |
| 2.2 ELECTRICAL ABSOLUTE RATINGS         |    |
| 2.2.1 TFT LCD MODULE                    |    |
| 2.2.2 BACKLIGHT UNIT                    |    |
| 3. ELECTRICAL CHARACTERISTICS           | 7  |
| 3.1 TFT LCD MODULE                      |    |
| 3.2 BACKLIGHT UNIT                      |    |
| 4. BLOCK DIAGRAM                        | 11 |
| 4.1 TFT LCD MODULE                      |    |
| 4.2 BACKLIGHT UNIT                      |    |
| 5. INPUT TERMINAL PIN ASSIGNMENT        | 12 |
| 5.1 TFT LCD MODULE                      |    |
| 5.2 BACKLIGHT UNIT                      |    |
| 5.3 TIMING DIAGRAM OF LVDS INPUT SIGNAL |    |
| 5.4 COLOR DATA INPUT ASSIGNMENT         |    |
| 5.5 EDID DATA STRUCTURE                 |    |
| 6. INVERTER SPECIFICATION               | 18 |
| 6.1 CONNECTOR TYPE                      |    |
| 6.2 INPUT CONNECTOR PIN ASSIGNMENT      |    |
| 6.3 OUTPUT CONNECTOR PIN ASSIGNMENT     |    |
| 6.4 GENERAL ELECTRICAL SPECIFICATION    |    |
| 7. INTERFACE TIMING                     | 22 |
| 7.1 INPUT SIGNAL TIMING SPECIFICATIONS  |    |
| 7.2 POWER ON/OFF SEQUENCE               |    |
| 8. OPTICAL CHARACTERISTICS              | 24 |
| 8.1 TEST CONDITIONS                     |    |
| 8.2 OPTICAL SPECIFICATIONS              |    |
| 9. PRECAUTIONS                          | 28 |
| 9.1 HANDLING PRECAUTIONS                |    |
| 9.2 STORAGE PRECAUTIONS                 |    |
| 9.3 OPERATION PRECAUTIONS               |    |
| 10. PACKING                             | 29 |
| 10.1 CARTON                             |    |
| 10.2 PALLET                             |    |
| 11. DEFINITION OF LABELS                | 31 |
| 11.1 CMO MODULE LABEL                   |    |
| 11.2 CARTON LABEL                       |    |

**REVISION HISTORY**

| Version | Date         | Page<br>(New) | Section | Description                                   |
|---------|--------------|---------------|---------|-----------------------------------------------|
| Ver 0.0 | May. 10. '06 | All           | All     | Tentative specification first issued.         |
| Ver 1.0 | Jun. 15. '06 | 4             | 1.5     | Mechanical Specification - depth              |
|         |              | 6             | 2.2.2   | Backlight Unit – lamp current, lamp frequency |
|         |              | 7             | 3.1     | TFT LCD Module – power supply current         |
|         |              | 9             | 3.2     | Backlight Unit                                |
|         |              | 12            | 5.1     | TFT LCD Module – Note(1) connector part no.   |
|         |              | 13            | 5.2     | Backlight Unit – connector pin definition     |
|         |              | 18            | 6       | Add Inverter Specification                    |
|         |              | 24            | 8.1     | Test Conditions                               |
|         |              | 24            | 8.2     | Optical Specifications                        |
|         |              | 32            | 11.3    | Carton Label                                  |



## 1 GENERAL DESCRIPTION

### 1.1 OVERVIEW

N154C1-L03 is a 15.4" TFT Liquid Crystal Display module with single CCFL Backlight unit and 30 pins LVDS interface. This module supports 1440 x 900 WXGA+ mode and can display 262,144 colors. The optimum viewing angle is at 6 o'clock direction. The inverter module for Backlight is not built in.

### 1.2 FEATURES

- Thin and light weight
- WXGA+ (1440 x 900 pixels) resolution
- DE (Data Enable) only mode
- 3.3V LVDS (Low Voltage Differential Signaling) interface with 2 pixel/clock
- Support EDID Structure Version 1.3

### 1.3 APPLICATION

- TFT LCD Notebook

### 1.4 GENERAL SPECIFICATIONS

| Item               | Specification             | Unit  | Note |
|--------------------|---------------------------|-------|------|
| Outline Dimension  | 344(W) x 222 (H)          | mm    | (1)  |
| Active Area        | 331.56 (H) x 207.225 (V)  | mm    |      |
| Bezel Opening Area | 335 (H) x 210.7 (V)       | mm    |      |
| Driver Element     | a-si TFT active matrix    | -     | -    |
| Pixel Number       | 1440 x R.G.B. x 900       | pixel | -    |
| Pixel Pitch        | 0.23025 (H) x 0.23025 (V) | mm    | -    |
| Pixel Arrangement  | RGB vertical stripe       | -     | -    |
| Display Colors     | 262,144                   | color | -    |
| Transmissive Mode  | Normally white            | -     | -    |
| Surface Treatment  | Hard coating (3H), Glare  | -     | -    |

### 1.5 MECHANICAL SPECIFICATIONS

| Item                            |               | Min.                                                                                                           | Typ. | Max.  | Unit | Note |
|---------------------------------|---------------|----------------------------------------------------------------------------------------------------------------|------|-------|------|------|
| Module Size                     | Horizontal(H) | 343.5                                                                                                          | 344  | 344.5 | mm   | (1)  |
|                                 | Vertical(V)   | 221.5                                                                                                          | 222  | 222.5 | mm   |      |
|                                 | Depth(D)      | ---                                                                                                            | ---  | 6.3   | mm   |      |
| Weight                          |               | ---                                                                                                            | 530  | 545   | g    | -    |
| I/F connector mounting position |               | The mounting inclination of the connector makes the screen center within $\pm 0.5\text{mm}$ as the horizontal. |      |       |      | (2)  |

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

## 2. ABSOLUTE MAXIMUM RATINGS

### 2.1 ABSOLUTE RATINGS OF ENVIRONMENT

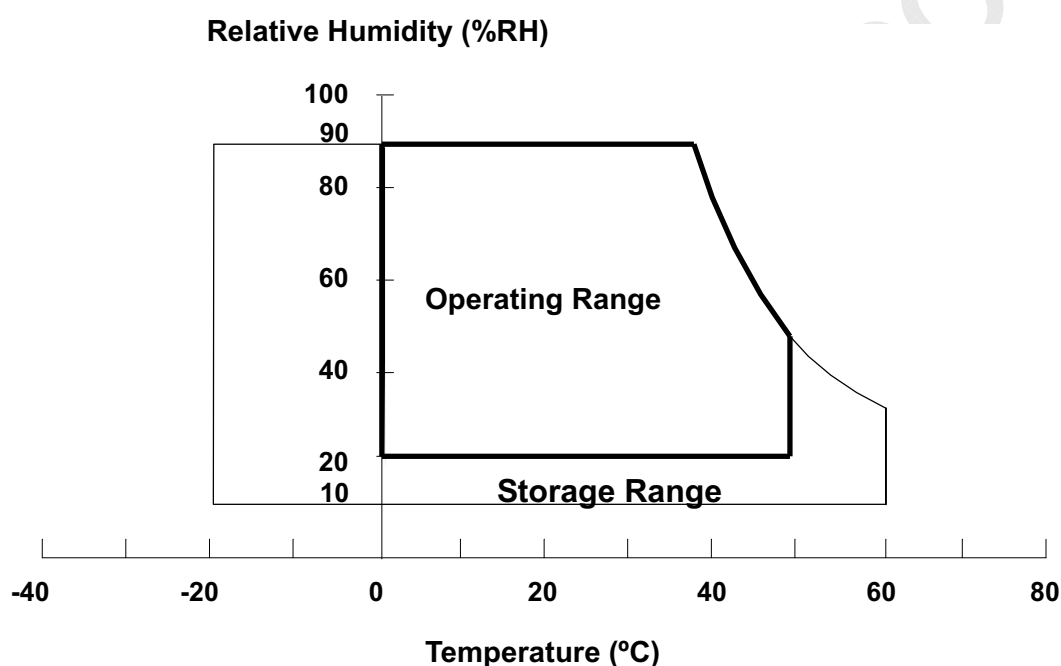
| Item                          | Symbol           | Value |       | Unit | Note     |
|-------------------------------|------------------|-------|-------|------|----------|
|                               |                  | Min.  | Max.  |      |          |
| Storage Temperature           | T <sub>ST</sub>  | -20   | +60   | °C   | (1)      |
| Operating Ambient Temperature | T <sub>OP</sub>  | 0     | +50   | °C   | (1), (2) |
| Shock (Non-Operating)         | S <sub>NOP</sub> | -     | 220/2 | G/ms | (3), (5) |
| Vibration (Non-Operating)     | V <sub>NOP</sub> | -     | 1.5   | G    | (4), (5) |

Note (1) (a) 90 %RH Max. (Ta ≤ 40 °C).

(b) Wet-bulb temperature should be 39 °C Max. (Ta > 40 °C).

(c) No condensation.

Note (2) The temperature of panel surface should be 0 °C min. and 50 °C max.

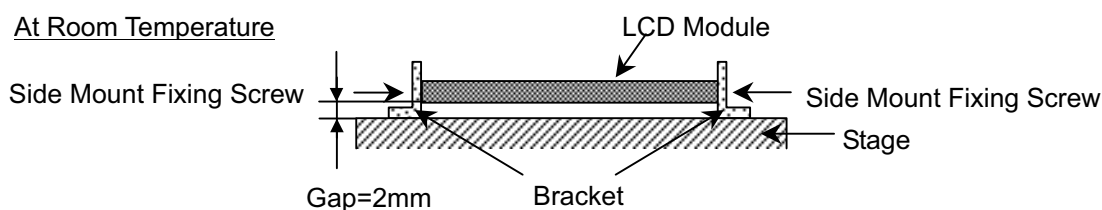


Note (3) 1 time for ± X, ± Y, ± Z. for Condition (220G / 2ms) is half Sine Wave,.

Note (4) 10~200 Hz, 0.5hr/cycle 1cycle for X,Y,Z

Note (5) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.

The fixing condition is shown as below:



## 2.2 ELECTRICAL ABSOLUTE RATINGS

### 2.2.1 TFT LCD MODULE

| Item                 | Symbol          | Value |                      | Unit | Note |
|----------------------|-----------------|-------|----------------------|------|------|
|                      |                 | Min.  | Max.                 |      |      |
| Power Supply Voltage | V <sub>CC</sub> | -0.3  | +4.0                 | V    | (1)  |
| Logic Input Voltage  | V <sub>IN</sub> | -0.3  | V <sub>CC</sub> +0.3 | V    |      |

### 2.2.2 BACKLIGHT UNIT

| Item           | Symbol         | Value |      | Unit              | Note                              |
|----------------|----------------|-------|------|-------------------|-----------------------------------|
|                |                | Min.  | Max. |                   |                                   |
| Lamp Voltage   | V <sub>L</sub> | -     | 2.5K | V <sub>RMS</sub>  | (1), (2), I <sub>L</sub> = 6.0 mA |
| Lamp Current   | I <sub>L</sub> | 2.0   | 7.0  | mA <sub>RMS</sub> | (1), (2)                          |
| Lamp Frequency | F <sub>L</sub> | 45    | 80   | KHz               |                                   |

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

Note (2) Specified values are for lamp (Refer to Section 3.2 for further information).

### 3 ELECTRICAL CHARACTERISTICS

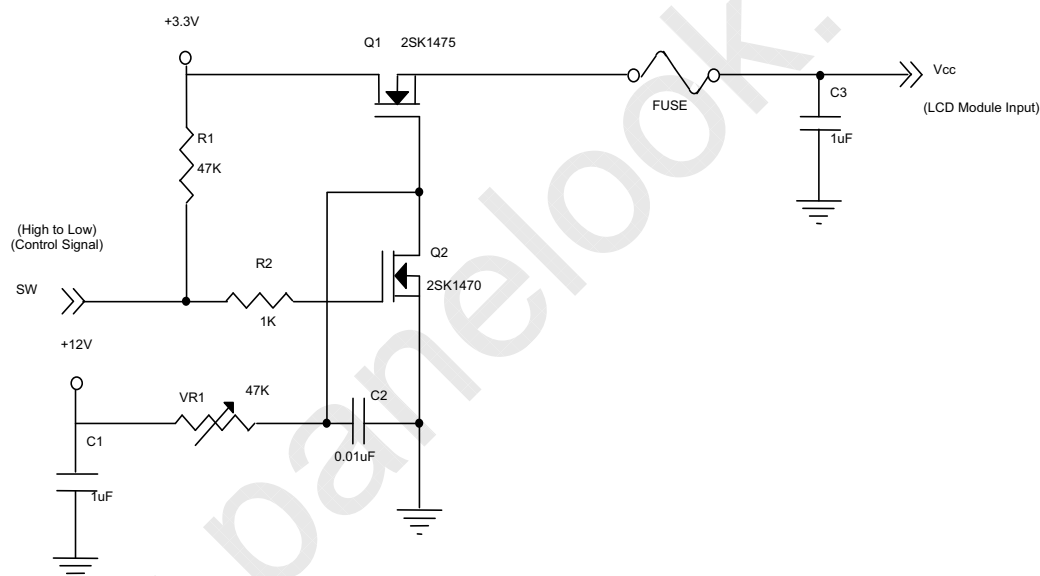
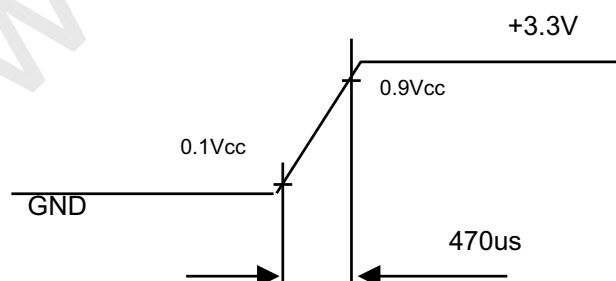
#### 3.1 TFT LCD MODULE

Ta = 25 ± 2 °C

| Parameter                                              |                 | Symbol            | Value |       |       | Unit | Note |
|--------------------------------------------------------|-----------------|-------------------|-------|-------|-------|------|------|
|                                                        |                 |                   | Min.  | Typ.  | Max.  |      |      |
| Power Supply Voltage                                   |                 | V <sub>CC</sub>   | 3.0   | 3.3   | 3.6   | V    | -    |
| Ripple Voltage                                         |                 | V <sub>RP</sub>   | -     | -     | 100   | mV   | -    |
| Rush Current                                           |                 | I <sub>RUSH</sub> | -     | -     | 1.5   | A    | (2)  |
| Power Supply Current                                   | White           | I <sub>CC</sub>   | -     | (320) | (350) | mA   | (3)a |
|                                                        | Black           |                   | -     | (470) | (500) | mA   | (3)b |
|                                                        | Vertical Stripe |                   | -     | (490) | (510) | mA   | (3)c |
| Differential Input Voltage for LVDS Receiver Threshold | "H" Level       | V <sub>IH</sub>   | -     | -     | +100  | mV   | -    |
|                                                        | "L" Level       | V <sub>IL</sub>   | -100  | -     | -     | mV   | -    |
| Terminating Resistor                                   |                 | R <sub>T</sub>    | -     | 100   | -     | Ohm  | -    |
| Power per EBL WG                                       |                 | P <sub>EBL</sub>  | -     | TBD   | -     | W    | (4)  |

Note (1) The module should be always operated within above ranges.

Note (2) Measurement Conditions:

**Vcc rising time is 470us**

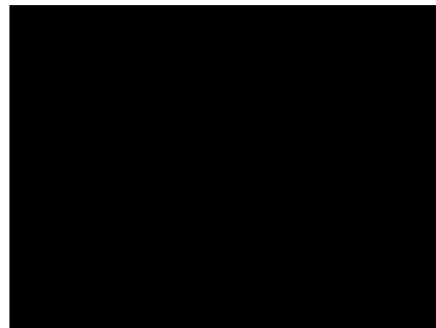
Note (3) The specified power supply current is under the conditions at  $V_{cc} = 3.3\text{ V}$ ,  $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$ , DC Current and  $f_v = 60\text{ Hz}$ , whereas a power dissipation check pattern below is displayed.

a. White Pattern



Active Area

b. Black Pattern



Active Area

Note (4) The specified power are the sum of LCD panel electronics input power and the inverter input power. Test conditions are as follows.

- (a)  $V_{cc} = 3.3\text{ V}$ ,  $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$ ,  $f_v = 60\text{ Hz}$ ,
- (b) The pattern used is a black and white 32 x 36 checkerboard, slide #100 from the VESA file "Flat Panel Display Monitor Setup Patterns", FPDMSU.ppt.
- (c) Luminance: 60 nits.
- (d) The inverter used is provided from O2Micro([www.o2micro.com](http://www.o2micro.com)). Please contact O2Micro for detail information. CMO don't provide the inverter in this product.

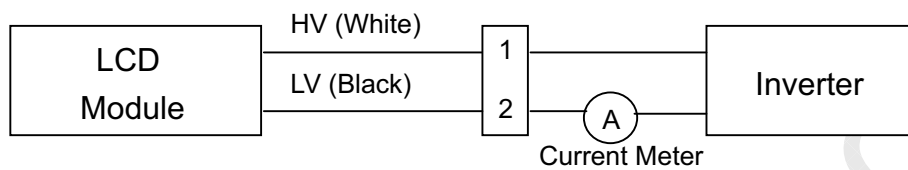


## 3.2 BACKLIGHT UNIT

Ta = 25 ± 2 °C

| Parameter            | Symbol          | Value  |      |                | Unit              | Note                         |
|----------------------|-----------------|--------|------|----------------|-------------------|------------------------------|
|                      |                 | Min.   | Typ. | Max.           |                   |                              |
| Lamp Input Voltage   | V <sub>L</sub>  | 657    | 730  | 803            | V <sub>RMS</sub>  | I <sub>L</sub> = 6.0 mA      |
| Lamp Current         | I <sub>L</sub>  | 2.0    | 6.0  | 7.0            | mA <sub>RMS</sub> | (1)                          |
| Lamp Turn On Voltage | V <sub>S</sub>  | -      | -    | (1460) (25 °C) | V <sub>RMS</sub>  | (2)                          |
|                      |                 | -      | -    | (1600) (0 °C)  | V <sub>RMS</sub>  | (2)                          |
| Operating Frequency  | F <sub>L</sub>  | 45     | 55   | 80             | KHz               | (3)                          |
| Power Consumption    | P <sub>L</sub>  | -      | 4.38 | -              | W                 | (4), I <sub>L</sub> = 6.0 mA |
| Lamp Life Time       | L <sub>BL</sub> | 15,000 | -    | -              | Hrs               | (5)                          |

Note (1) Lamp current is measured by utilizing a high frequency current meter as shown below:



Note (2) The voltage that must be larger than V<sub>S</sub> should be applied to the lamp for more than 1 second after startup. Otherwise, the lamp may not be turned on normally.

Note (3) The lamp frequency may generate interference with horizontal synchronous frequency from the display, and this may cause line flow on the display. In order to avoid interference, the lamp frequency should be detached from the horizontal synchronous frequency and its harmonics as far as possible.

Note (4)  $P_L = I_L \times V_L$

Note (5) The lifetime of lamp is defined as the time when it continues to operate under the conditions at Ta = 25 ± 2 °C and I<sub>L</sub> = 6.0 mA<sub>RMS</sub> until one of the following events occurs:

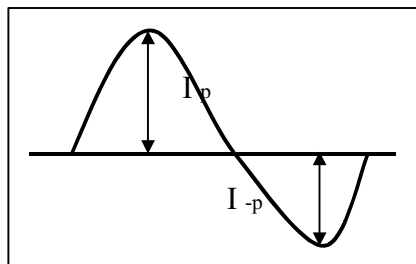
- (a) When the brightness becomes or lower than 50% of its original value.
- (b) When the effective ignition length becomes or lower than 80% of its original value. (Effective ignition length is defined as an area that the brightness is less than 70% compared to the center point.)

Note (6) The waveform of the voltage output of inverter must be area-symmetric and the design of the inverter must have specifications for the modularized lamp. The performance of the Backlight, such as lifetime or brightness, is greatly influenced by the characteristics of the DC-AC inverter for the lamp. All the parameters of an inverter should be carefully designed to avoid generating too much current leakage from high voltage output of the inverter. When designing or ordering the inverter please make sure that a poor lighting caused by the mismatch of the Backlight and the inverter (miss-lighting, flicker, etc.) never occurs. If the above situation is confirmed, the module should be operated in the same manners when it is installed in your instrument.

Requirements for a system inverter design, which is intended to have a better display performance, a better power efficiency and a more reliable lamp. It shall help increase the lamp lifetime and reduce its leakage current.

- a. The asymmetry rate of the inverter waveform should be 10% below;

- b. The distortion rate of the waveform should be within  $\sqrt{2} \pm 10\%$ ;
- c. The ideal sine wave form shall be symmetric in positive and negative polarities.



\* Asymmetry rate:

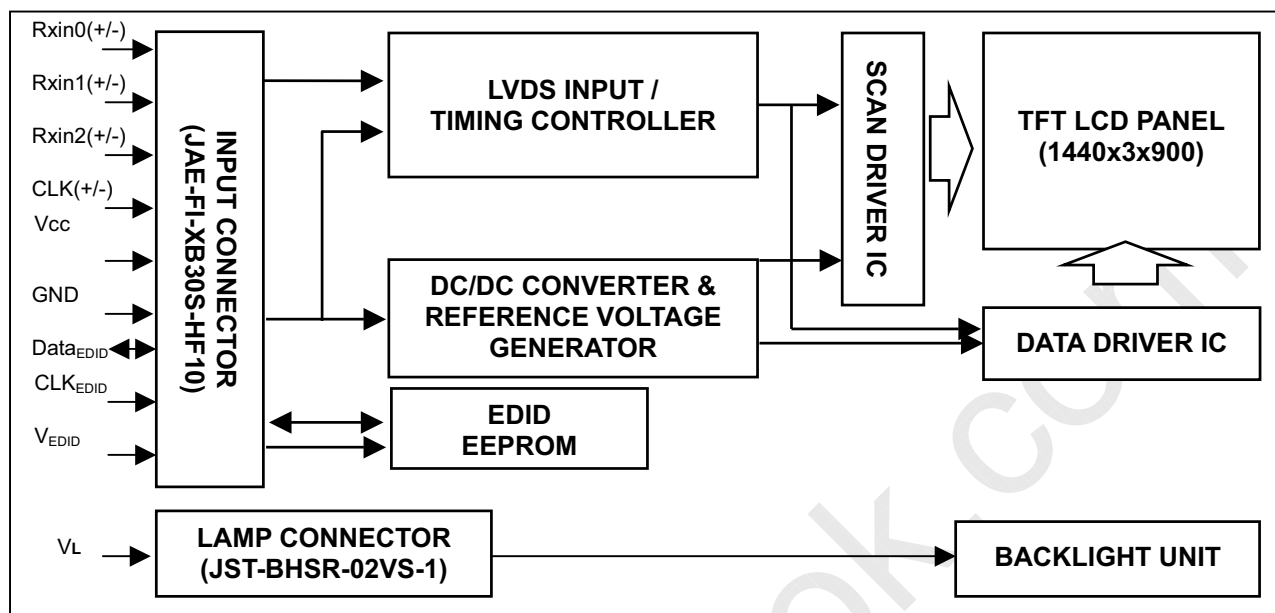
$$|I_p - I_{-p}| / I_{rms} * 100\%$$

\* Distortion rate

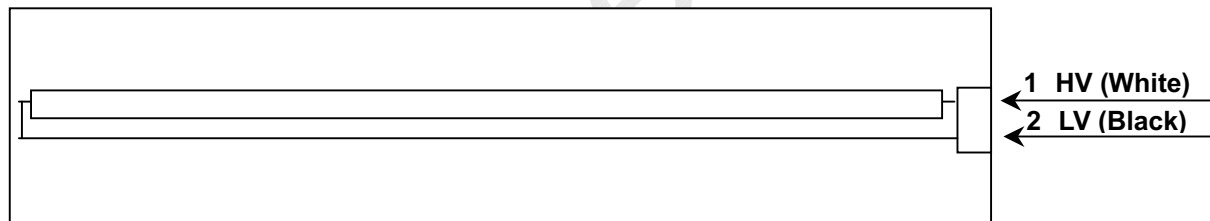
$$I_p \text{ (or } I_{-p}) / I_{rms}$$

## 4 BLOCK DIAGRAM

### 4.1 TFT LCD MODULE



### 4.2 BACKLIGHT UNIT



## 5 INPUT TERMINAL PIN ASSIGNMENT

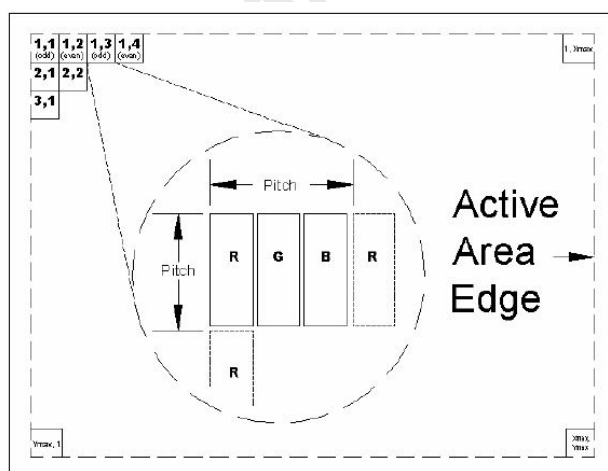
### 5.1 TFT LCD MODULE

| Pin | Symbol               | Description                         | Polarity | Remark |
|-----|----------------------|-------------------------------------|----------|--------|
| 1   | Vss                  | Ground                              |          |        |
| 2   | Vcc                  | Power Supply +3.3 V (typical)       |          |        |
| 3   | Vcc                  | Power Supply +3.3 V (typical)       |          |        |
| 4   | V <sub>EDID</sub>    | DDC 3.3V Power                      |          |        |
| 5   | BIST                 | Panel BIST enable                   |          |        |
| 6   | CLK <sub>EDID</sub>  | DDC Clock                           |          |        |
| 7   | DATA <sub>EDID</sub> | DDC Data                            |          | -      |
| 8   | RXO0-                | LVDS Differential Data Input (Odd)  | Negative |        |
| 9   | RXO0+                | LVDS Differential Data Input (Odd)  | Positive |        |
| 10  | Vss                  | Ground                              |          |        |
| 11  | RXO1-                | LVDS Differential Data Input (Odd)  | Negative |        |
| 12  | RXO1+                | LVDS Differential Data Input (Odd)  | Positive |        |
| 13  | Vss                  | Ground                              |          |        |
| 14  | RXO2-                | LVDS Differential Data Input (Odd)  | Negative |        |
| 15  | RXO2+                | LVDS Differential Data Input (Odd)  | Positive |        |
| 16  | Vss                  | Ground                              |          |        |
| 17  | RXOC-                | LVDS Clock Data Input (Odd)         | Negative |        |
| 18  | RXOC+                | LVDS Clock Data Input (Odd)         | Positive |        |
| 19  | Vss                  | Ground                              |          |        |
| 20  | RxE0-                | LVDS Differential Data Input (Even) | Negative |        |
| 21  | RxE0+                | LVDS Differential Data Input (Even) | Positive |        |
| 22  | Vss                  | Ground                              |          |        |
| 23  | RxE1-                | LVDS Differential Data Input (Even) | Negative |        |
| 24  | RxE1+                | LVDS Differential Data Input (Even) | Positive |        |
| 25  | Vss                  | Ground                              |          |        |
| 26  | RxE2-                | LVDS Differential Data Input (Even) | Negative |        |
| 27  | RxE2+                | LVDS Differential Data Input (Even) | Positive |        |
| 28  | Vss                  | Ground                              |          |        |
| 29  | RXEC-                | LVDS Clock Data Input (Even)        | Negative |        |
| 30  | RXEC+                | LVDS Clock Data Input (Even)        | Positive |        |

Note (1) Connector Part No.: JAE-FI-XB30SRL-HF11

Note (2) User's connector Part No: JAE-FI-X30C2L

Note (3) The first pixel is odd as shown in the following figure.



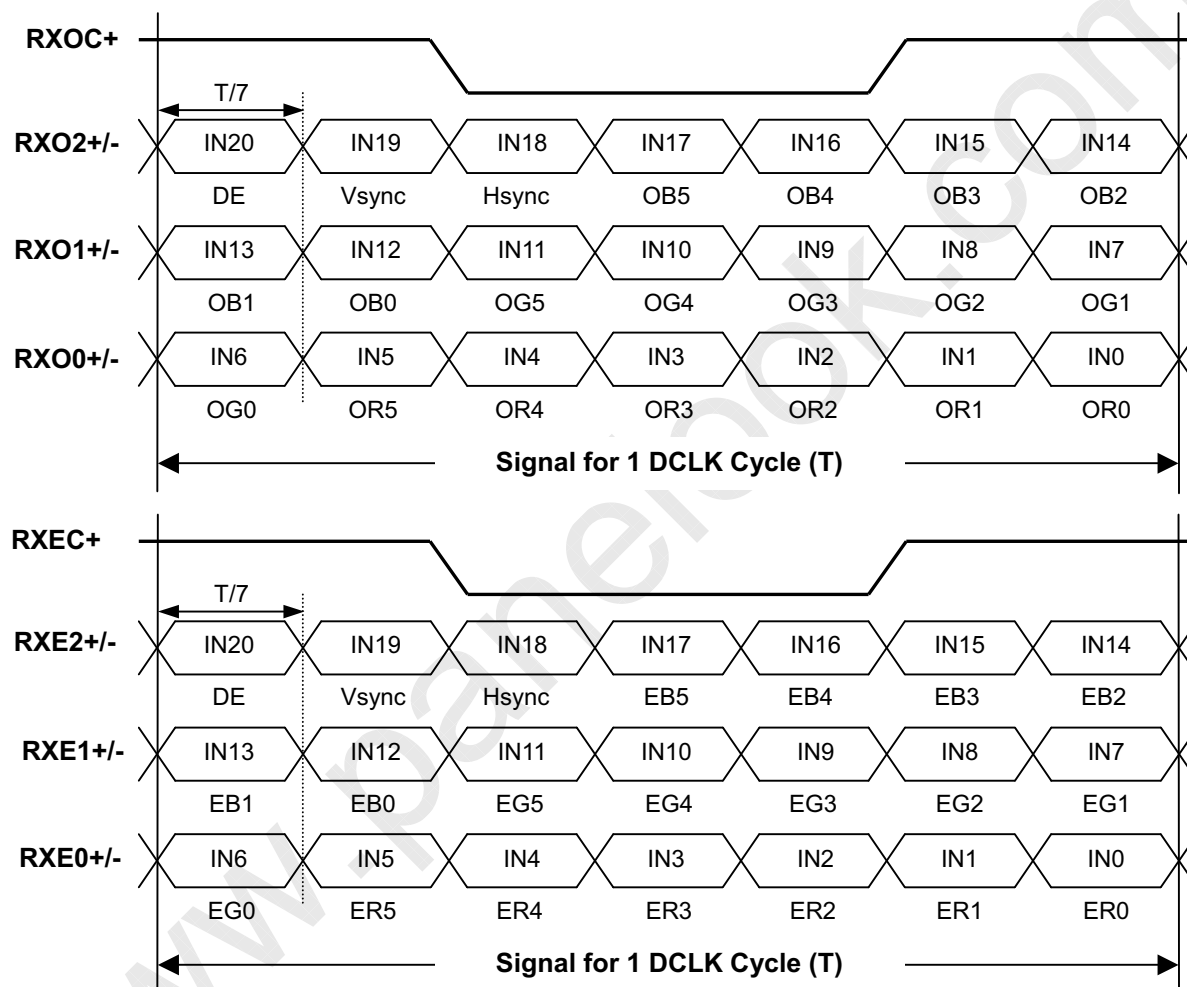
## 5.2 BACKLIGHT UNIT

| Pin | Symbol | Description  | Color |
|-----|--------|--------------|-------|
| 1   | HV     | High Voltage | White |
| 2   | LV     | Ground       | Black |

Note (1) Connector Part No.: JST-BHSR-02VS-1 or equivalent

Note (2) User's connector Part No.: JST-SM02B-BHSS-1-TB or equivalent

## 5.3 TIMING DIAGRAM OF LVDS INPUT SIGNAL



## 5.4 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 6-bit gray scale data input for the color. The higher the binary input the brighter the color. The table below provides the assignment of color versus data input.

| Color               |               | Data Signal |    |    |    |    |    |       |    |    |    |    |    |      |    |    |    |    |    |
|---------------------|---------------|-------------|----|----|----|----|----|-------|----|----|----|----|----|------|----|----|----|----|----|
|                     |               | Red         |    |    |    |    |    | Green |    |    |    |    |    | Blue |    |    |    |    |    |
|                     |               | R5          | R4 | R3 | R2 | R1 | R0 | G5    | G4 | G3 | G2 | G1 | G0 | B5   | B4 | B3 | B2 | B1 | B0 |
| Basic Colors        | Black         | 0           | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Red           | 1           | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Green         | 0           | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Blue          | 0           | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  |
|                     | Cyan          | 0           | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1    | 1  | 1  | 1  | 1  | 1  |
|                     | Magenta       | 1           | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  |
|                     | Yellow        | 1           | 1  | 1  | 1  | 1  | 1  | 1     | 1  | 1  | 1  | 1  | 1  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | White         | 1           | 1  | 1  | 1  | 1  | 1  | 1     | 1  | 1  | 1  | 1  | 1  | 1    | 1  | 1  | 1  | 1  | 1  |
| Gray Scale Of Red   | Red(0)/Dark   | 0           | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Red(1)        | 0           | 0  | 0  | 0  | 0  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Red(2)        | 0           | 0  | 0  | 0  | 1  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | :             | :           | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |
|                     | :             | :           | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |
|                     | :             | :           | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |
|                     | Red(61)       | 1           | 1  | 1  | 1  | 0  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Red(62)       | 1           | 1  | 1  | 1  | 1  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
| Red(63)             | 1             | 1           | 1  | 1  | 1  | 1  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  |    |
| Gray Scale Of Green | Green(0)/Dark | 0           | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Green(1)      | 0           | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 1  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Green(2)      | 0           | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 1  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | :             | :           | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |
|                     | :             | :           | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |
|                     | :             | :           | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |
|                     | Green(61)     | 0           | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 0  | 1  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Green(62)     | 0           | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
| Green(63)           | 0             | 0           | 0  | 0  | 0  | 0  | 1  | 1     | 1  | 1  | 1  | 1  | 0  | 0    | 0  | 0  | 0  | 0  |    |
| Gray Scale Of Blue  | Blue(0)/Dark  | 0           | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Blue(1)       | 0           | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 1  |
|                     | Blue(2)       | 0           | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 1  | 0  |
|                     | :             | :           | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |
|                     | :             | :           | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |
|                     | :             | :           | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |
|                     | Blue(61)      | 0           | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 0  | 1  |
|                     | Blue(62)      | 0           | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 0  |
| Blue(63)            | 0             | 0           | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 1  | 1    | 1  | 1  | 1  | 1  |    |

Note (1) 0: Low Level Voltage, 1: High Level Voltage

## 5.5 EDID DATA STRUCTURE

The EDID (Extended Display Identification Data) data formats are to support displays as defined in the VESA Plug & Display and FPD1 standards.

| Byte #<br>(decimal) | Byte #<br>(hex) | Field Name and Comments                      | Value<br>(hex) | Value<br>(binary) |
|---------------------|-----------------|----------------------------------------------|----------------|-------------------|
| 0                   | 0               | Header                                       | 00             | 00000000          |
| 1                   | 1               | Header                                       | FF             | 11111111          |
| 2                   | 2               | Header                                       | FF             | 11111111          |
| 3                   | 3               | Header                                       | FF             | 11111111          |
| 4                   | 4               | Header                                       | FF             | 11111111          |
| 5                   | 5               | Header                                       | FF             | 11111111          |
| 6                   | 6               | Header                                       | FF             | 11111111          |
| 7                   | 7               | Header                                       | 00             | 00000000          |
| 8                   | 8               | EISA ID manufacturer name ("CMO")            | 0D             | 00001101          |
| 9                   | 9               | EISA ID manufacturer name (Compressed ASCII) | AF             | 10101111          |
| 10                  | 0A              | ID product code (N154C1-L03)                 | 38             | 00111000          |
| 11                  | 0B              | ID product code (hex LSB first; N154C1-L03)  | 15             | 00010101          |
| 12                  | 0C              | ID S/N (fixed "0")                           | 00             | 00000000          |
| 13                  | 0D              | ID S/N (fixed "0")                           | 00             | 00000000          |
| 14                  | 0E              | ID S/N (fixed "0")                           | 00             | 00000000          |
| 15                  | 0F              | ID S/N (fixed "0")                           | 00             | 00000000          |
| 16                  | 10              | Week of manufacture (fixed week code)        | 1A             | 00011010          |
| 17                  | 11              | Year of manufacture (fixed year code)        | 10             | 00010000          |
| 18                  | 12              | EDID structure version # ("1")               | 01             | 00000001          |
| 19                  | 13              | EDID revision # ("3")                        | 03             | 00000011          |
| 20                  | 14              | Video I/P definition ("digital")             | 80             | 10000000          |
| 21                  | 15              | Active area horizontal 33.156cm              | 21             | 00100001          |
| 22                  | 16              | Active area vertical 20.7225cm               | 15             | 00010101          |
| 23                  | 17              | Display Gamma (Gamma = "2.2")                | 78             | 01111000          |
| 24                  | 18              | Feature support ("Active off, RGB Color")    | 0A             | 00001010          |
| 25                  | 19              | Rx1 Rx0 Ry1 Ry0 Gx1 Gx0 Gy1 Gy0              | DD             | 11011101          |
| 26                  | 1A              | Bx1 Bx0 By1 By0 Wx1 Wx0 Wy1 Wy0              | 68             | 01101000          |
| 27                  | 1B              | Red-x (Rx = "0.593")                         | 97             | 10010111          |
| 28                  | 1C              | Red-y (Ry = "0.337")                         | 56             | 01010110          |
| 29                  | 1D              | Green-x (Gx = "0.315")                       | 50             | 01010000          |
| 30                  | 1E              | Green-y (Gy = "0.528")                       | 87             | 10000111          |
| 31                  | 1F              | Blue-x (Bx = "0.149")                        | 26             | 00100110          |
| 32                  | 20              | Blue-y (By = "0.119")                        | 1E             | 00011110          |
| 33                  | 21              | White-x (Wx = "0.307")                       | 4E             | 01001110          |
| 34                  | 22              | White-y (Wy = "0.316")                       | 51             | 01010001          |
| 35                  | 23              | Established timings 1                        | 00             | 00000000          |
| 36                  | 24              | Established timings 2                        | 00             | 00000000          |
| 37                  | 25              | Manufacturer's reserved timings              | 00             | 00000000          |
| 38                  | 26              | Standard timing ID # 1                       | 01             | 00000001          |
| 39                  | 27              | Standard timing ID # 1                       | 01             | 00000001          |
| 40                  | 28              | Standard timing ID # 2                       | 01             | 00000001          |
| 41                  | 29              | Standard timing ID # 2                       | 01             | 00000001          |

|    |    |                                                                                          |    |          |
|----|----|------------------------------------------------------------------------------------------|----|----------|
| 42 | 2A | Standard timing ID # 3                                                                   | 01 | 00000001 |
| 43 | 2B | Standard timing ID # 3                                                                   | 01 | 00000001 |
| 44 | 2C | Standard timing ID # 4                                                                   | 01 | 00000001 |
| 45 | 2D | Standard timing ID # 4                                                                   | 01 | 00000001 |
| 46 | 2E | Standard timing ID # 5                                                                   | 01 | 00000001 |
| 47 | 2F | Standard timing ID # 5                                                                   | 01 | 00000001 |
| 48 | 30 | Standard timing ID # 6                                                                   | 01 | 00000001 |
| 49 | 31 | Standard timing ID # 6                                                                   | 01 | 00000001 |
| 50 | 32 | Standard timing ID # 7                                                                   | 01 | 00000001 |
| 51 | 33 | Standard timing ID # 7                                                                   | 01 | 00000001 |
| 52 | 34 | Standard timing ID # 8                                                                   | 01 | 00000001 |
| 53 | 35 | Standard timing ID # 8                                                                   | 01 | 00000001 |
| 54 | 36 | Detailed timing description # 1 Pixel clock ("88.75MHz", According to VESA CVT Rev1.1)   | AB | 10101011 |
| 55 | 37 | # 1 Pixel clock (hex LSB first)                                                          | 22 | 00100010 |
| 56 | 38 | # 1 H active ("1440")                                                                    | A0 | 10100000 |
| 57 | 39 | # 1 H blank ("160")                                                                      | A0 | 10100000 |
| 58 | 3A | # 1 H active : H blank ("1440 : 160")                                                    | 50 | 01010000 |
| 59 | 3B | # 1 V active ("900")                                                                     | 84 | 10000100 |
| 60 | 3C | # 1 V blank ("26")                                                                       | 1A | 00011010 |
| 61 | 3D | # 1 V active : V blank ("900 : 26")                                                      | 30 | 00110000 |
| 62 | 3E | # 1 H sync offset ("48")                                                                 | 30 | 00110000 |
| 63 | 3F | # 1 H sync pulse width ("32")                                                            | 20 | 00100000 |
| 64 | 40 | # 1 V sync offset : V sync pulse width ("3 : 6")                                         | 36 | 00110110 |
| 65 | 41 | # 1 H sync offset : H sync pulse width : V sync offset : V sync width ("48: 32 : 3 : 6") | 00 | 00000000 |
| 66 | 42 | # 1 H image size ("332 mm")                                                              | 4C | 01001100 |
| 67 | 43 | # 1 V image size ("207 mm")                                                              | CF | 11001111 |
| 68 | 44 | # 1 H image size : V image size ("332 : 207")                                            | 10 | 00010000 |
| 69 | 45 | # 1 H boarder ("0")                                                                      | 00 | 00000000 |
| 70 | 46 | # 1 V boarder ("0")                                                                      | 00 | 00000000 |
| 71 | 47 | # 1 Non-interlaced, Normal, no stereo, Separate sync, H/V pol Negatives                  | 18 | 00011000 |
| 72 | 48 | Detailed timing description # 2                                                          | 00 | 00000000 |
| 73 | 49 | # 2 Flag                                                                                 | 00 | 00000000 |
| 74 | 4A | # 2 Reserved                                                                             | 00 | 00000000 |
| 75 | 4B | # 2 FE (hex) defines ASCII string (Model Name "N154C1-L03", ASCII)                       | FE | 11111110 |
| 76 | 4C | # 2 Flag                                                                                 | 00 | 00000000 |
| 77 | 4D | # 2 1st character of name ("N")                                                          | 4E | 01001110 |
| 78 | 4E | # 2 2nd character of name ("1")                                                          | 31 | 00110001 |
| 79 | 4F | # 2 3rd character of name ("5")                                                          | 35 | 00110101 |
| 80 | 50 | # 2 4th character of name ("4")                                                          | 34 | 00110100 |
| 81 | 51 | # 2 5th character of name ("C")                                                          | 43 | 01000011 |
| 82 | 52 | # 2 6th character of name ("1")                                                          | 31 | 00110001 |
| 83 | 53 | # 2 7th character of name ("-")                                                          | 2D | 00101101 |
| 84 | 54 | # 2 8th character of name ("L")                                                          | 4C | 01001100 |
| 85 | 55 | # 2 9th character of name ("0")                                                          | 30 | 00110000 |




**CHI MEI**  
OPTOELECTRONICS CORP.

Issued Date: Jun.15, 2006

Model No.: N154C1-L03

**Preliminary**

|     |    |                                                                   |    |          |
|-----|----|-------------------------------------------------------------------|----|----------|
| 86  | 56 | # 2 9th character of name ("3")                                   | 33 | 00110011 |
| 87  | 57 | # 2 New line character indicates end of ASCII string              | 0A | 00001010 |
| 88  | 58 | # 2 Padding with "Blank" character                                | 20 | 00100000 |
| 89  | 59 | # 2 Padding with "Blank" character                                | 20 | 00100000 |
| 90  | 5A | Detailed timing description # 3                                   | 00 | 00000000 |
| 91  | 5B | # 3 Flag                                                          | 00 | 00000000 |
| 92  | 5C | # 3 Reserved                                                      | 00 | 00000000 |
| 93  | 5D | # 3 FE (hex) defines ASCII string (Vendor "CMO", ASCII)           | FE | 11111110 |
| 94  | 5E | # 3 Flag                                                          | 00 | 00000000 |
| 95  | 5F | # 3 1st character of string ("C")                                 | 43 | 01000011 |
| 96  | 60 | # 3 2nd character of string ("M")                                 | 4D | 01001101 |
| 97  | 61 | # 3 3rd character of string ("O")                                 | 4F | 01001111 |
| 98  | 62 | # 3 New line character indicates end of ASCII string              | 0A | 00001010 |
| 99  | 63 | # 3 Padding with "Blank" character                                | 20 | 00100000 |
| 100 | 64 | # 3 Padding with "Blank" character                                | 20 | 00100000 |
| 101 | 65 | # 3 Padding with "Blank" character                                | 20 | 00100000 |
| 102 | 66 | # 3 Padding with "Blank" character                                | 20 | 00100000 |
| 103 | 67 | # 3 Padding with "Blank" character                                | 20 | 00100000 |
| 104 | 68 | # 3 Padding with "Blank" character                                | 20 | 00100000 |
| 105 | 69 | # 3 Padding with "Blank" character                                | 20 | 00100000 |
| 106 | 6A | # 3 Padding with "Blank" character                                | 20 | 00100000 |
| 107 | 6B | # 3 Padding with "Blank" character                                | 20 | 00100000 |
| 108 | 6C | Detailed timing description # 4                                   | 00 | 00000000 |
| 109 | 6D | # 4 Flag                                                          | 00 | 00000000 |
| 110 | 6E | # 4 Reserved                                                      | 00 | 00000000 |
| 111 | 6F | # 4 FE (hex) defines ASCII string (Model Name"N141C1-L02", ASCII) | FE | 11111110 |
| 112 | 70 | # 4 Flag                                                          | 00 | 00000000 |
| 113 | 71 | # 4 1st character of name ("N")                                   | 4E | 01001110 |
| 114 | 72 | # 4 2nd character of name ("1")                                   | 31 | 00110001 |
| 115 | 73 | # 4 3rd character of name ("5")                                   | 35 | 00110101 |
| 116 | 74 | # 4 4th character of name ("4")                                   | 34 | 00110100 |
| 117 | 75 | # 4 5th character of name ("C")                                   | 43 | 01000011 |
| 118 | 76 | # 4 6th character of name ("1")                                   | 31 | 00110001 |
| 119 | 77 | # 4 7th character of name ("-")                                   | 2D | 00101101 |
| 120 | 78 | # 4 8th character of name ("L")                                   | 4C | 01001100 |
| 121 | 79 | # 4 9th character of name ("0")                                   | 30 | 00110000 |
| 122 | 7A | # 4 9th character of name ("3")                                   | 33 | 00110011 |
| 123 | 7B | # 4 New line character indicates end of ASCII string              | 0A | 00001010 |
| 124 | 7C | # 4 Padding with "Blank" character                                | 20 | 00100000 |
| 125 | 7D | # 4 Padding with "Blank" character                                | 20 | 00100000 |
| 126 | 7E | Extension flag                                                    | 00 | 00000000 |
| 127 | 7F | Checksum                                                          | A0 | 10100000 |

## 6 INVERTER SPECIFICATION

### 6.1 Connector type

Input connector type: **LVC-D20SFYG** (HONDA)

Output connector: **JST SM02B-BHSS-1-TB** (JST)

### 6.2 Input connector pin assignment

Input Connector pin assignment:

| Input connector |             | Comments                                                                                                                            |
|-----------------|-------------|-------------------------------------------------------------------------------------------------------------------------------------|
| HONDA           | LVC-D20SFYG |                                                                                                                                     |
| Pin             | Function    |                                                                                                                                     |
| 1               | INV_SRC     | This power rail should be used as a power rail to drive the backlight DC-AC converter                                               |
| 2               | INV_SRC     | This power rail should be used as a power rail to drive the backlight DC-AC converter                                               |
| 3               | INV_SRC     | This power rail should be used as a power rail to drive the backlight DC-AC converter                                               |
| 4               | INV_SRC     | This power rail should be used as a power rail to drive the backlight DC-AC converter                                               |
| 5               | GND         | Ground                                                                                                                              |
| 6               | NC          | No Connection                                                                                                                       |
| 7               | 5VALW       | This should be used as power source that stores the brightness/contrast values & the circuit that interfaces with SMB_CLK & SMB_DAT |
| 8               | GND         | Ground                                                                                                                              |
| 9               | SMB_DAT     | SMBus interface for sending brightness & contrast information to the inverter/panel                                                 |
| 10              | SMB_CLK     | SMBus interface for sending brightness & contrast information to the inverter/panel                                                 |
| 11              | GND         | Ground                                                                                                                              |
| 12              | INV_PWM     | System side PWM input signal for brightness control                                                                                 |
| 13              | GND         | Ground                                                                                                                              |
| 14              | NC          | No Connection                                                                                                                       |
| 15 ~ 20         | NC          | No Connection                                                                                                                       |

Absolute maximum ratings

| Items                            | Absolute max. ratings | Unit |
|----------------------------------|-----------------------|------|
| INV_SRC (Voltage)                | -1.0~23.5             | V    |
| FPBACK/SMB_CLK/SMB_DAT (Voltage) | -1.0~5.5              | V    |

## 6.3 Output connector pin assignment

| Pin | Name     | Description                     |
|-----|----------|---------------------------------|
| 1   | CFL-High | High-voltage output to the CCFL |
| 2   | CFL-Low  | Low-voltage output to the CCFL  |

## 6.4 General electrical specification:

## 6.4.1 Absolute maximum ratings

| Items                            | Absolute max. ratings | Unit |
|----------------------------------|-----------------------|------|
| INV_SRC (Voltage)                | -1.0~23.5             | V    |
| FPBACK/SMB_CLK/SMB_DAT (Voltage) | -1.0~5.5              | V    |

## 6.4.2 Electrical characteristics:

| No. | Item                                     | Symbol         | Condition                                                 | Min. | Typ. | Max. | Unit |
|-----|------------------------------------------|----------------|-----------------------------------------------------------|------|------|------|------|
| 1   | Input Voltage                            | INV_SRC        |                                                           | 7.5  | 14.4 | 21   | V    |
| 2   | Input Signal Level for 5VSUS             | 5VSUS          |                                                           | -    | -    | -    | V    |
| 3   | Input Signal Level for 5VALW             | 5VALW          |                                                           | 4.75 | 5    | 5.2  | V    |
| 4   | Input Power                              | Pin(Max)       | 185nits@Vin=12V                                           | -    | -    | 4.6  | W    |
| 5   | Brightness Adjust (Lamp Current Control) | SMB_DAT        | Control by SMBus(256 steps dimming control)               | 00H  | -    | FFH  | -    |
| 6   | Output Voltage                           | Vout           | IL = 6.3mA(typ)                                           | 612  | 680  | 748  | Vrms |
| 7   | Output Current                           | Iout (Min)     | Vin=7.5V~21V SMB_DAT=00H<br>Ta=25℃, after running 30 min. | 1.5  | 1.8  | 2.1  | mA   |
|     |                                          | Iout (Max)     | Vin=7.5V~21V SMB_DAT=FFH<br>Ta=25℃, after running 30 min. | 6    | 6.3  | 6.6  | mA   |
| 8   | Operation Frequency                      | Freq           | Vin=7.5V~21V                                              | 45   | -    | 65   | KHz  |
| 9   | Burst mode frequency                     | f <sub>B</sub> | Vin=7.5V~21V                                              | 200  | -    | 220  | Hz   |
| 10  | Open Lamp Voltage                        | Vopen          | No Load                                                   | 1400 | --   | 1800 | Vrms |
| 11  | Striking Time                            | Ts             | No Loadw                                                  | 0.6  | 1    | 1.4  | Sec  |
| 12  | Efficiency                               | η              | Vin=7.5V, SMB_DAT=FFH<br>(RES LOAD=100K ohm)              | 80   | -    | -    | %    |
| 13  | Start and Delay Time                     |                | Vin=14.4V,<br>SMB_DAT=00H                                 | -    | 130  | 200  | μS   |
| 14  | Start -up time<br>(Turn on delay time)   |                | Vin=14.4V,<br>SMB_DAT=FFH                                 | -    | -    | 0.1  | Sec  |



- Input Voltage

The operating input voltage of inverter shall be defined.

The inverter shall ignite the CCFL lamp at minimum input voltage at any environment conditions.

- On/Off control

Enable: At “**ON**” condition (FPBACK=Hi), enable the inverter.

Disable: At “**OFF**” condition (FPBACK=Lo), disable the inverter.

- Quiescent current

At the inverter “**OFF**” condition, input quiescent should be less than 0.1mA.

- Open lamp voltage

The inverter start-up output voltage will be above “**Vopen**” for “**Ts**” minimum at any condition under specify until lamp to be ignited. The inverter should be shutdown if lamp ignition was failed in “**Ts**” maximum. The inverter shall be capable of withstanding the output connections open without component over-stress / fire / smoke /arc.

- Burst mode frequency

The burst mode frequency should be in specification in any environment condition and electrical condition.

- Brightness control

SM-BUS values for panel luminance are to be included in the on LCD board EEDID ROM chip table. The supplier will measure panel luminance in a system and define the SMBUS values for each of the 8 required luminance levels. The panel luminance, for which SMBUS values will be provided in the EEDID from byte # 113(hex #71), to byte # 120, (hex # 78), is show in the table below. The inverter supplier should provide these appropriate values to CMO.

| Step Count        | Step 1   | Step 2   | Step3    | Step 4   | Step 5   | Step 6   | Step 7   | Step 8   |
|-------------------|----------|----------|----------|----------|----------|----------|----------|----------|
| Address           | Byte 113 | Byte 114 | Byte 115 | Byte 116 | Byte 117 | Byte 118 | Byte 119 | Byte 120 |
| SM-Bus Data Value | 22       | 31       | 3A       | 42       | 61       | 88       | A2       | BC       |
| Luminance (nits)  | 10       | 17       | 24       | 30       | 60       | 110      | 150      | Max      |

- Output ripple ratio

$$\text{Ripple ratio} = 2 * (I_{\text{peak}} - I_{\text{valley}}) / (I_{\text{peak}} + I_{\text{valley}}) * 100\%$$

The Ripple ratio should be less than 5% and ripple frequency should be less than 200 Hz.

- Power up Overshoot & Undershoot

Overshoot & Undershoot at power up should not exceed the following limits.

| Vin         | Output current<br>Io(rms) | Io (dI)<br>Overshoot/Undershoot | Settling time<br>(dT) |
|-------------|---------------------------|---------------------------------|-----------------------|
| 0→Vin(min.) | Io(max.)                  | 150% / 50%                      | 5 ms max.             |
|             | Io(min.)                  |                                 |                       |
| 0→Vin(typ.) | Io(max.)                  | 150% / 50%                      | 5 ms max.             |
|             | Io(min.)                  |                                 |                       |
| 0→Vin(max.) | Io(max.)                  | 150% / 50%                      | 5 ms max.             |
|             | Io(min.)                  |                                 |                       |

$$dI = I_{max} - I_o \quad \text{or} \quad dI = (I_o - I_{min}) / I_o$$

- Output connections short protection

The inverter shall be capable of withstanding the output connections short without damage or over-stress.

And the inverter maximum input power shall be limited within 1W.

#### 6.4.3 Mechanical Drawing

#### 6.4.4 Other Information

- Safety

- The inverter shall meet the requirement of "Limited current circuits" in paragraphs 2.4.1 in IEC60950. There is no fire/smoke while simulating the component of the inverter open/short test.
- The Inverter AND panel must be UL certified with CB certificate and LCC (Limited Current Circuit) test and test reports from UL. Inverter panel combo must pass Dell Safety requirements.

- EMI

The inverter must meet the radiated limitation requirement of CISPR22 class B, FCC-B and VCCI level II with 6dB margin minimum while the inverter operating in the complete system.

- Environment Regulation

- Follow the RoHS requirement.
- Fill in CMO's official document <<Environmentally Conscious Products Questionnaire for Suppliers of Materials, Parts, and Products>> and turn in to CMO before CMO's specification approval process.

- Dell's other requirements

1. The inverter must not emit any audible noise.
2. Please refer to CMO's official document. "General Inverter Specification for LCD Module" for other general information such as reliability test, safety and etc..
3. Please also refer to DELL's official document about inverter:
  - LCD Backlight Design Spec X00-04
  - DELL's LCD Inverter Qualification Plan, Rev. A00
  - Prohibited Components
  - "Holy Stone(禾申堂)"s products are prohibited.

#### Confidential Notice

Remind that all the information described in this document is confidential. Please don't reveal to other people else before getting CMO's agreement.

## 7 INTERFACE TIMING

### 7.1 INPUT SIGNAL TIMING SPECIFICATIONS

The input signal timing specifications are shown as the following table and timing diagram.

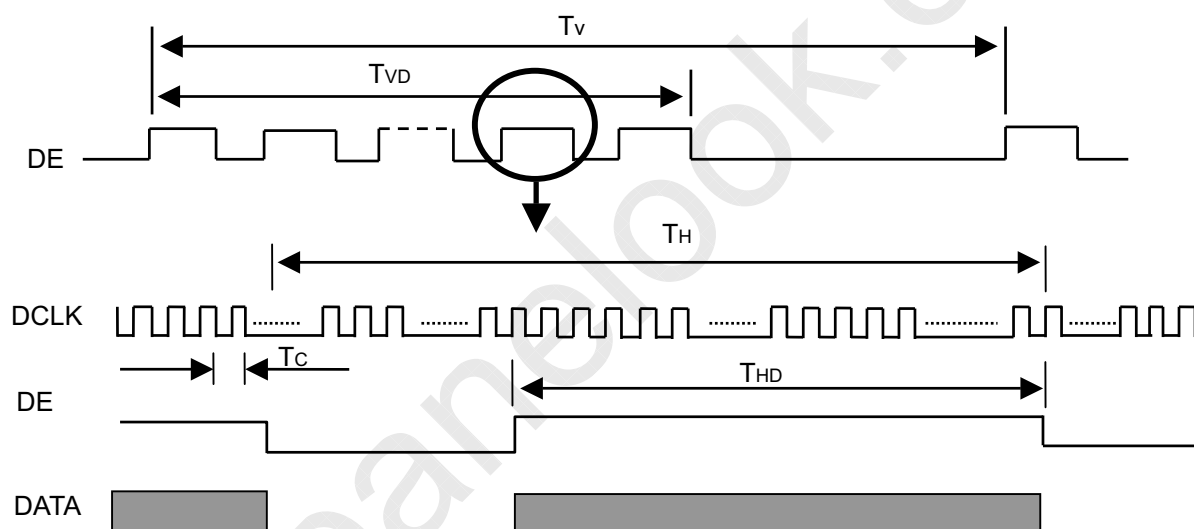
The input signal timing specifications are shown as the following table and timing diagram.

| Signal | Item                       | Symbol | Min. | Typ. | Max. | Unit | Note |
|--------|----------------------------|--------|------|------|------|------|------|
| DCLK   | Frequency                  | 1/Tc   | 25   | 44.5 | 60   | MHz  | (2)  |
| DE     | Vertical Total Time        | TV     | 910  | 926  | 1500 | TH   | -    |
|        | Vertical Addressing Time   | TVD    | 900  | 900  | 900  | TH   | -    |
|        | Horizontal Total Time      | TH     | 760  | 800  | 880  | Tc   | (2)  |
|        | Horizontal Addressing Time | THD    | 720  | 720  | 720  | Tc   | (2)  |

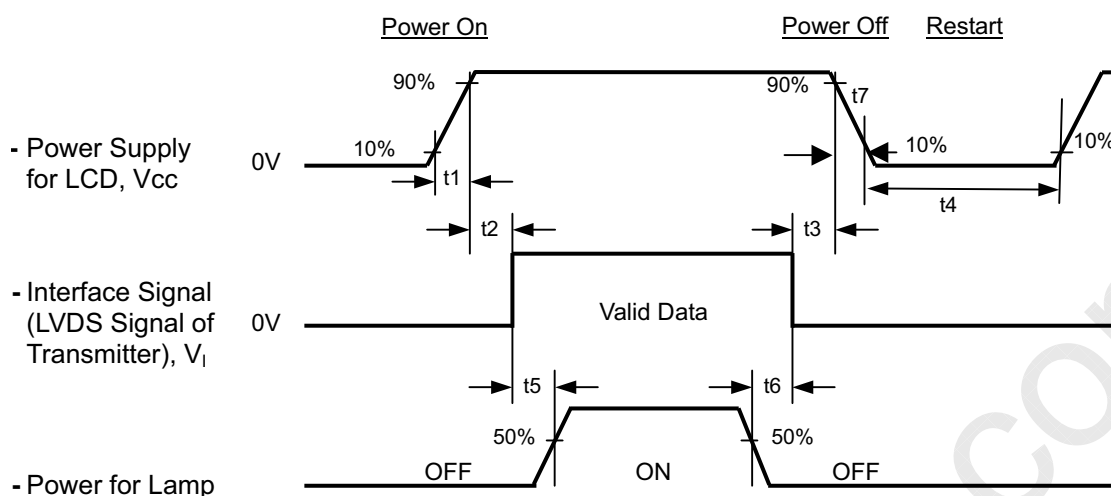
Note (1) Because this module is operated by DE only mode, Hsync and Vsync are ignored.

(2) 2 channels LVDS input.

#### INPUT SIGNAL TIMING DIAGRAM



## 7.2 POWER ON/OFF SEQUENCE



## Timing Specifications:

$$0.5 < t1 \leq 10 \text{ msec}$$

$$0 < t2 \leq 50 \text{ msec}$$

$$0 < t3 \leq 50 \text{ msec}$$

$$t4 \geq 500 \text{ msec}$$

$$t5 \geq 200 \text{ msec}$$

$$t6 \geq 200 \text{ msec}$$

Note (1) Please avoid floating state of interface signal at invalid period.

Note (2) When the interface signal is invalid, be sure to pull down the power supply of LCD Vcc to 0 V.

Note (3) The Backlight inverter power must be turned on after the power supply for the logic and the interface signal is valid. The Backlight inverter power must be turned off before the power supply for the logic and the interface signal is invalid.

Note (4) Sometimes some slight noise shows when LCD is turned off (even backlight is already off). To avoid this phenomenon, we suggest that the Vcc falling time had better to follow

$$t7 \geq 5 \text{ msec}$$

## 8 OPTICAL CHARACTERISTICS

### 8.1 TEST CONDITIONS

| Item                       | Symbol                                                        | Value     | Unit |
|----------------------------|---------------------------------------------------------------|-----------|------|
| Ambient Temperature        | Ta                                                            | 25±2      | °C   |
| Ambient Humidity           | Ha                                                            | 50±10     | %RH  |
| Supply Voltage             | V <sub>CC</sub>                                               | 3.3       | V    |
| Input Signal               | According to typical value in "3. ELECTRICAL CHARACTERISTICS" |           |      |
| Inverter Current           | I <sub>L</sub>                                                | 6.0       | mA   |
| Inverter Driving Frequency | F <sub>L</sub>                                                | <b>61</b> | KHz  |
| Inverter                   | Sumida-H05-4915                                               |           |      |

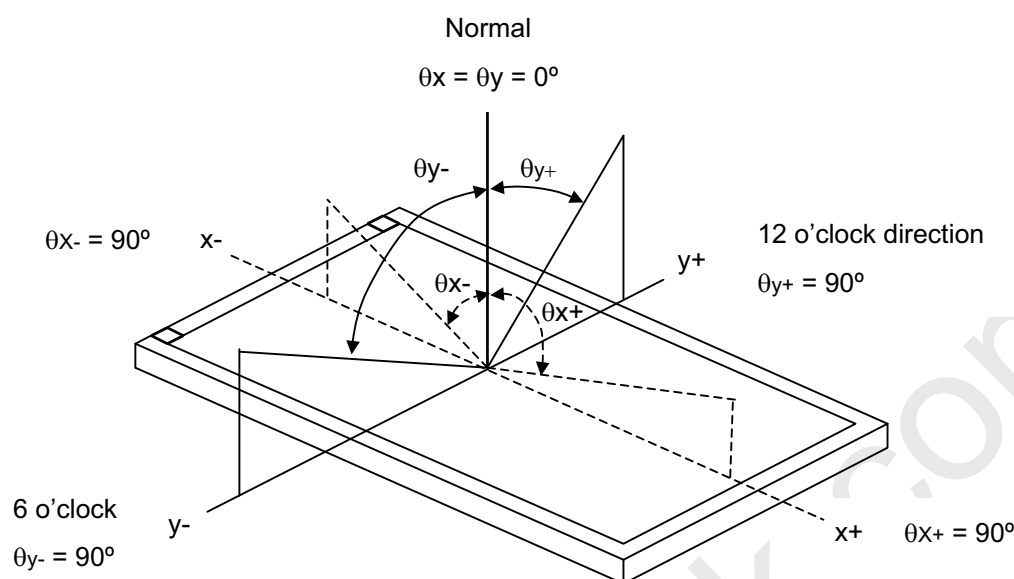
The measurement methods of optical characteristics are shown in Section 8.2. The following items should be measured under the test conditions described in Section 8.1 and stable environment shown in Note (5).

### 8.2 OPTICAL SPECIFICATIONS

| Item                       |            | Symbol           | Condition                                                    | Min.         | Typ.    | Max.         | Unit              | Note     |
|----------------------------|------------|------------------|--------------------------------------------------------------|--------------|---------|--------------|-------------------|----------|
| Contrast Ratio             |            | CR               | $\theta_x=0^\circ, \theta_y=0^\circ$<br>Viewing Normal Angle | 400          | 600     | -            | -                 | (2), (5) |
| Response Time              |            | T <sub>R</sub>   |                                                              | -            | (6)     | (11)         | ms                | (3)      |
|                            |            | T <sub>F</sub>   |                                                              | -            | (14)    | (19)         | ms                |          |
| Average Luminance of White |            | L <sub>AVE</sub> |                                                              | 220          | 250     | -            | cd/m <sup>2</sup> | (4), (5) |
| Luminance Non-Uniformity   |            | $\delta W_{5p}$  |                                                              | -            | -       | 20           | %                 | (5), (6) |
|                            |            | $\delta W_{13p}$ |                                                              | -            | -       | 35           | %                 |          |
| Color Gamut                |            | C.G              |                                                              | -            | 45      | -            | %                 | (5), (7) |
| Color Chromaticity         | Red        | R <sub>x</sub>   |                                                              | TYP<br>-0.02 | (0.593) | TYP<br>+0.02 | -                 | (1), (5) |
|                            |            | R <sub>y</sub>   |                                                              |              | (0.341) |              | -                 |          |
|                            | Green      | G <sub>x</sub>   |                                                              |              | (0.318) |              | -                 |          |
|                            |            | G <sub>y</sub>   |                                                              |              | (0.541) |              | -                 |          |
|                            | Blue       | B <sub>x</sub>   |                                                              |              | (0.150) |              | -                 |          |
|                            |            | B <sub>y</sub>   |                                                              |              | (0.136) |              | -                 |          |
|                            | White      | W <sub>x</sub>   |                                                              |              | 0.313   |              | -                 |          |
|                            |            | W <sub>y</sub>   |                                                              |              | 0.329   |              | -                 |          |
| Viewing Angle              | Horizontal | $\theta_{x+}$    | CR≥10                                                        | 55           | 60      | -            | Deg.              |          |
|                            |            | $\theta_{x-}$    |                                                              | 55           | 60      | -            |                   |          |
|                            | Vertical   | $\theta_{y+}$    |                                                              | 45           | 50      | -            |                   |          |
|                            |            | $\theta_{y-}$    |                                                              | 45           | 50      | -            |                   |          |



Note (1) Definition of Viewing Angle ( $\theta_x$ ,  $\theta_y$ ):



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{63} / L_0$$

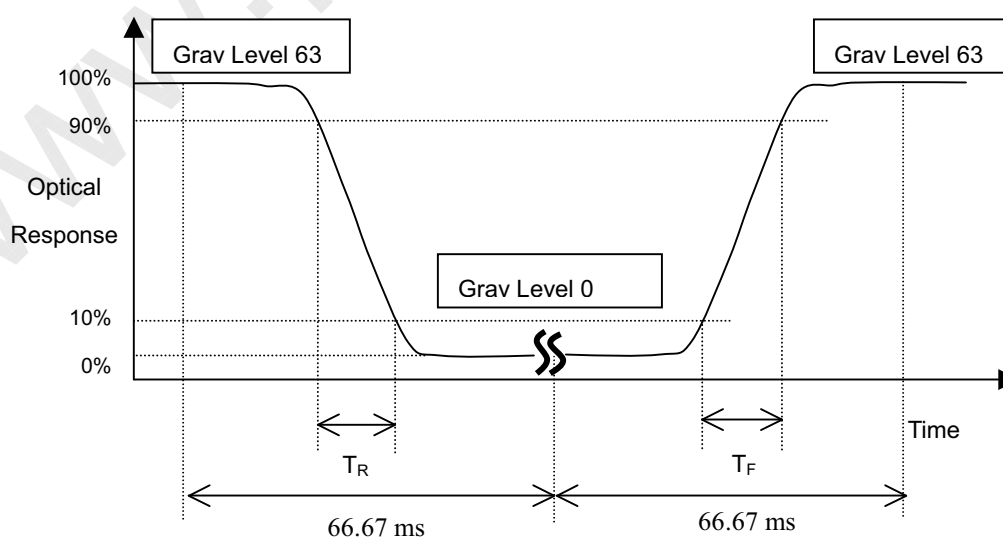
L63: Luminance of gray level 63

L 0: Luminance of gray level 0

$$\text{CR} = \text{CR} (5)$$

**CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).**

Note (3) Definition of Response Time ( $T_R$ ,  $T_F$ ):



Note (4) Definition of Average Luminance of White ( $L_{AVE}$ ):

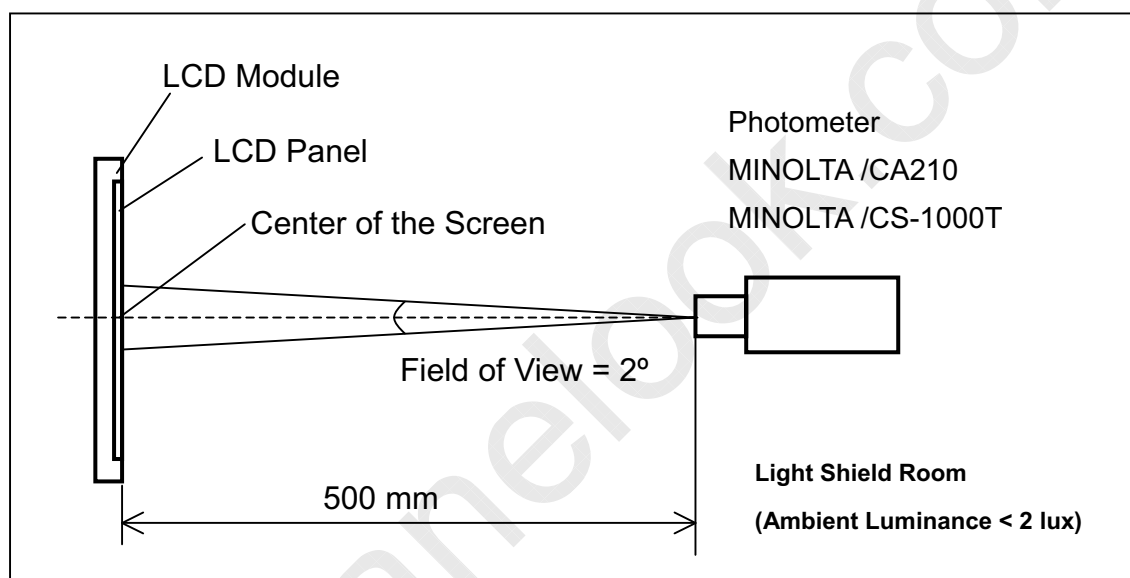
Measure the luminance of gray level 63 at 5 points

$$L_{AVE} = [L(5) + L(10) + L(11) + L(12) + L(13)] / 5$$

$L(x)$  is corresponding to the luminance of the point X at Figure in Note (6).

Note (5) Measurement Setup:

The LCD module should be stabilized at given temperature for 15 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 15 minutes in a windless room.

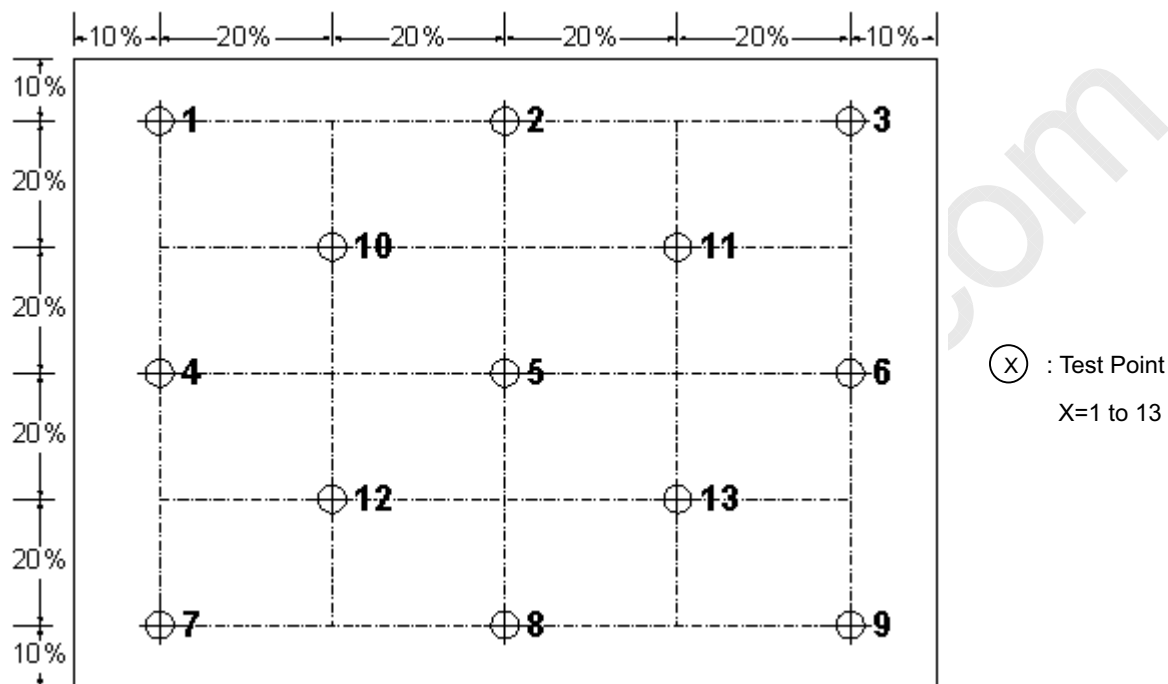


Note (6) Definition of White Variation ( $\delta W_{5p}$ ,  $\delta W_{13p}$ ):

Measure the luminance of gray level 63 at 5, 13 points

$$\delta W_{5p} = \{1 - \{ \text{Minimum} [L(5) + L(10) + L(11) + L(12) + L(13)] / \text{Maximum} [L(5) + L(10) + L(11) + L(12) + L(13)] \} \} * 100\%$$

$$\delta W_{13p} = \{1 - \{ \text{Minimum} [L(1) \sim L(13)] / \text{Maximum} [L(1) \sim L(13)] \} \} * 100\%$$



Note (7) Definition of Color Gamut (C.G):

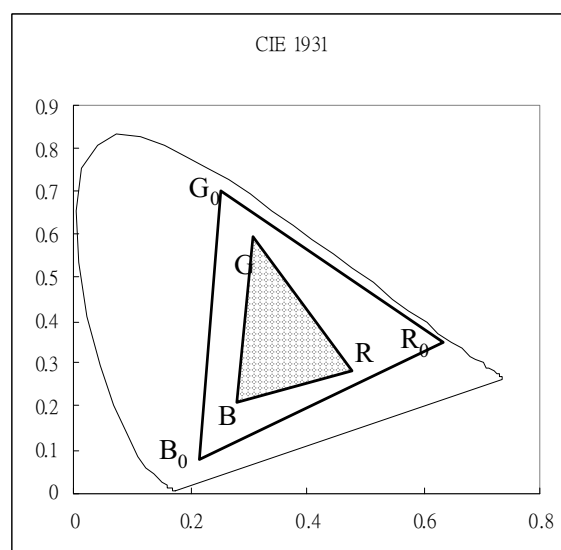
$$C.G = R G B / R_0 G_0 B_0 * 100\%$$

$R_0, G_0, B_0$ : color coordinates of red, green, and blue defined by NTSC, respectively.

$R, G, B$ : color coordinates of module on 63 gray levels of red, green, and blue, respectively.

$R_0 G_0 B_0$ : area of triangle defined by  $R_0, G_0, B_0$

$R G B$ : area of triangle defined by  $R, G, B$



## 9 PRECAUTIONS

### 9.1 HANDLING PRECAUTIONS

- (1) The module should be assembled into the system firmly by using every mounting hole. Be careful not to twist or bend the module.
- (2) While assembling or installing modules, it can only be in the clean area. The dust and oil may cause electrical short or damage the polarizer.
- (3) Use fingerstalls or soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (4) Do not press or scratch the surface harder than a HB pencil lead on the panel because the polarizer is very soft and easily scratched.
- (5) If the surface of the polarizer is dirty, please clean it by some absorbent cotton or soft cloth. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanently damage the polarizer due to chemical reaction.
- (6) Wipe off water droplets or oil immediately. Staining and discoloration may occur if they left on panel for a long time.
- (7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contacting with hands, legs or clothes, it must be washed away thoroughly with soap.
- (8) Protect the module from static electricity, it may cause damage to the C-MOS Gate Array IC.
- (9) Do not disassemble the module.
- (10) Do not pull or fold the lamp wire.
- (11) Pins of I/F connector should not be touched directly with bare hands.

### 9.2 STORAGE PRECAUTIONS

- (1) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.
- (2) It is dangerous that moisture come into or contacted the LCD module, because the moisture may damage LCD module when it is operating.
- (3) It may reduce the display quality if the ambient temperature is lower than 10 °C. For example, the response time will become slowly, and the starting voltage of lamp will be higher than the room temperature.

### 9.3 OPERATION PRECAUTIONS

- (1) Do not pull the I/F connector in or out while the module is operating.
- (2) Always follow the correct power on/off sequence when LCD module is connecting and operating. This can prevent the CMOS LSI chips from damage during latch-up.
- (3) The startup voltage of Backlight is approximately 1000 Volts. It may cause electrical shock while assembling with inverter. Do not disassemble the module or insert anything into the Backlight unit.

## 10 PACKING

## 10.1 CARTON

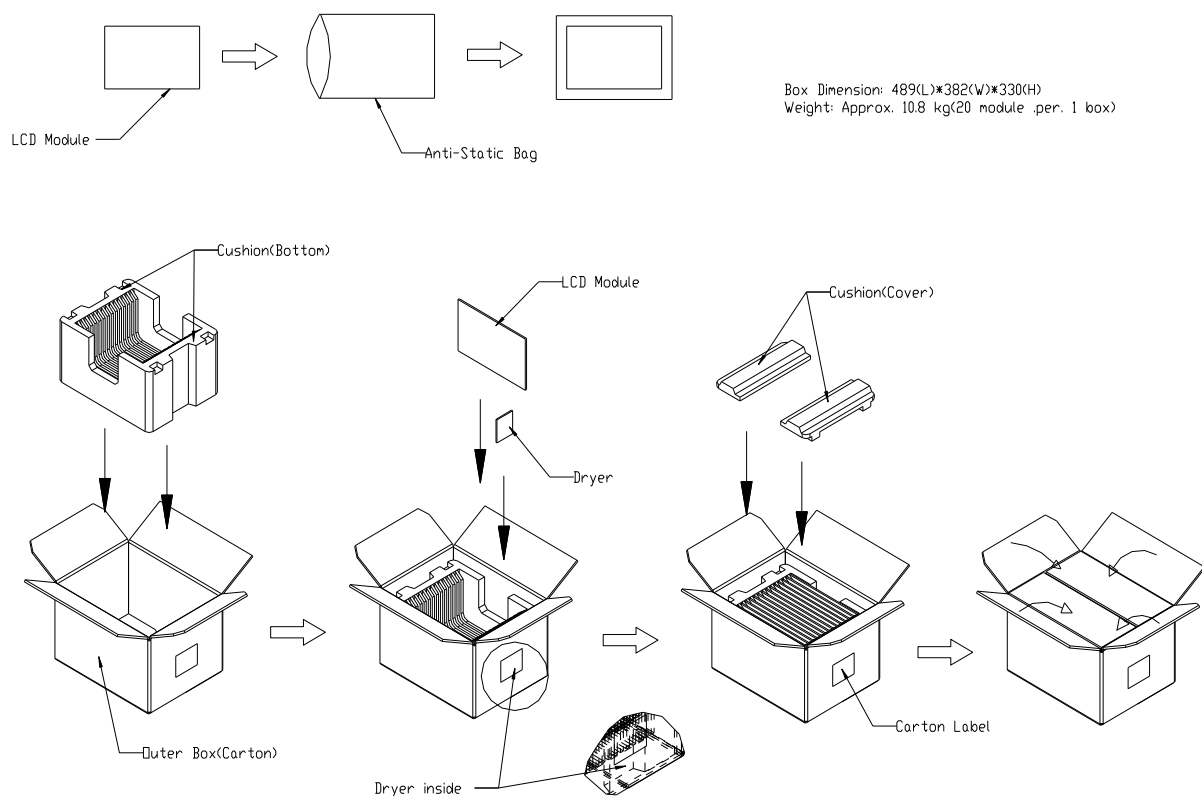


Figure. 10-1 Packing method

## 10.2 PALLET

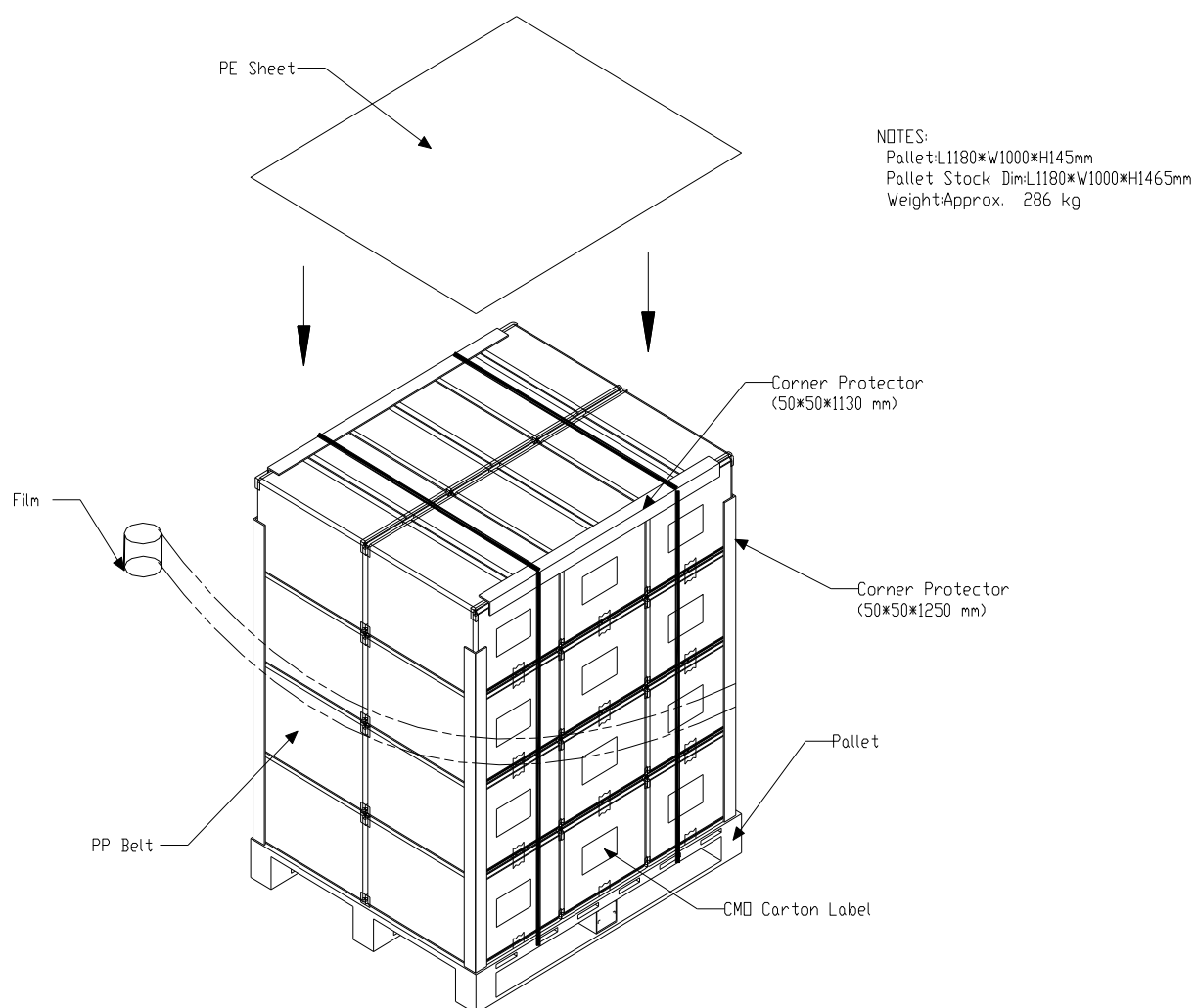


Figure. 10-2 Packing method

## 11 DEFINITION OF LABELS

### 11.1 CMO MODULE LABEL

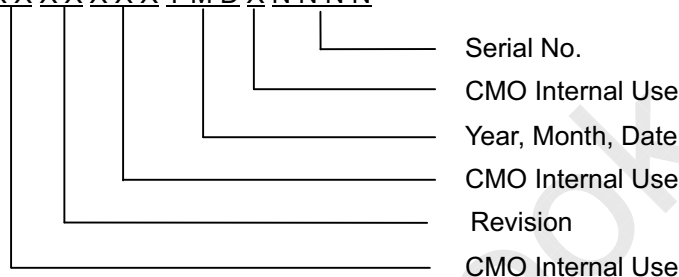
The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.



(a) Model Name: N154C1-L03

(b) Revision: Rev. XX, for example: A1, ..., C1, C2 ...etc.

(c) Serial ID: XXXXXXXYMDXNNNN



(d) Production Location: MADE IN XXXX. XXXX stands for production location.

Serial ID includes the information as below:

(a) Manufactured Date: Year: 1~9, for 2001~2009

Month: 1~9, A~C, for Jan. ~ Dec.

Day: 1~9, A~Y, for 1<sup>st</sup> to 31<sup>st</sup>, exclude I, O and U

(b) Revision Code: cover all the change

(c) Serial No.: Manufacturing sequence of product

### 11.2 CARTON LABEL



(a) Production location: Made In XXXX. XXXX stands for production location



### 11.3 CARTON LABEL

|                                                                                                                             |                                                                                                                      |                                                                                                      |
|-----------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| PKG ID (3S)124161241729112345609886C20<br> |                                                                                                                      | <br>REV.A06         |
| DP/N 03J849<br>                            | Vendor ID Loc Id<br>12416 12416<br> |                                                                                                      |
| BOX Qty 20<br>                             | Made in Taiwan<br>                  | Mfg Id<br>70896<br> |

#### Type J Label

- Verdana font or equivalent,bold
- 20pt.-all fields
- 203 DPI printer minimum
- Code 128B
- 10-15 mil minimum narrow bar
- .75"minimum barcode height
- .10" or greater quiet zone
- 4.0" x 6.0" label size
- Brady THT -25-402-1 or equivalent
- Brady R6107 series ribbon or equivalent

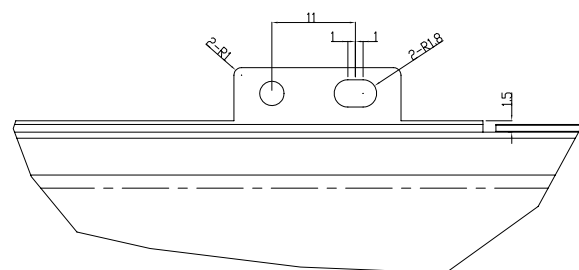
### 11.4 PALLET LABEL

|                                                                                                                               |                  |                                                   |                          |
|-------------------------------------------------------------------------------------------------------------------------------|------------------|---------------------------------------------------|--------------------------|
| FROM :CMO Corporation<br>Tainan,<br>Taiwan 744 R.O.C                                                                          |                  | TO:DELL COMPUTER<br>2128 West Braker<br>Austin TX |                          |
| P.O.NUMBER<br>12345678<br>                 |                  |                                                   |                          |
|                                            |                  | DELL P/N<br>12345                                 |                          |
| COUNTRY OF ORIGIN<br>TW<br>                |                  |                                                   |                          |
|                                            |                  | PACKING LIST#<br>1234567890123                    |                          |
| PACKING LIST QTY<br>654321<br>             |                  |                                                   |                          |
|                                            |                  | DESTINATION MAS LOC<br>60                         |                          |
| DESTINATION LOCATION<br>B4<br>             |                  |                                                   |                          |
| AIRBILL NUMBER<br>12345678901234567890<br> |                  |                                                   |                          |
| PKG CNT<br>999 OF 999                                                                                                         | BOX CNT<br>12345 | REVISION<br>A00-00                                | SHIP DATE<br>Apr 29,2003 |
| PART DESCRIPTION XXXXXXXXXXXXXXXXXXXXXXXX<br>12345678901234567890123456789012345678901                                        |                  |                                                   |                          |

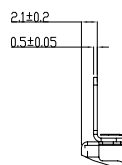
#### Type K Label

- Verdana font or equivalent,bold
- 12pt.-all descript fields
- 10pt.-all data fields
- 203 DPI printer minimum
- Code 128B
- 10 mil minimum narrow bar
- .30-.50"minimum barcode height
- .10" or greater quiet zone
- 4.0" x 6.5" label size
- Brady THT -78-402-.9 or equivalent
- Brady R6107 series ribbon or equivalent

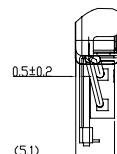




DETAIL A  
SCALE 4:1  
(2 Places)



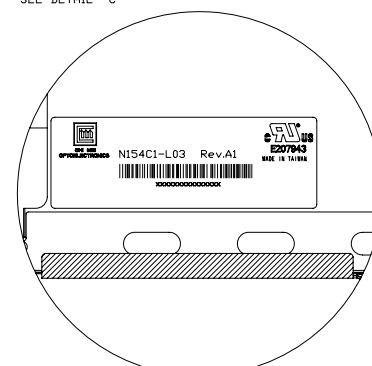
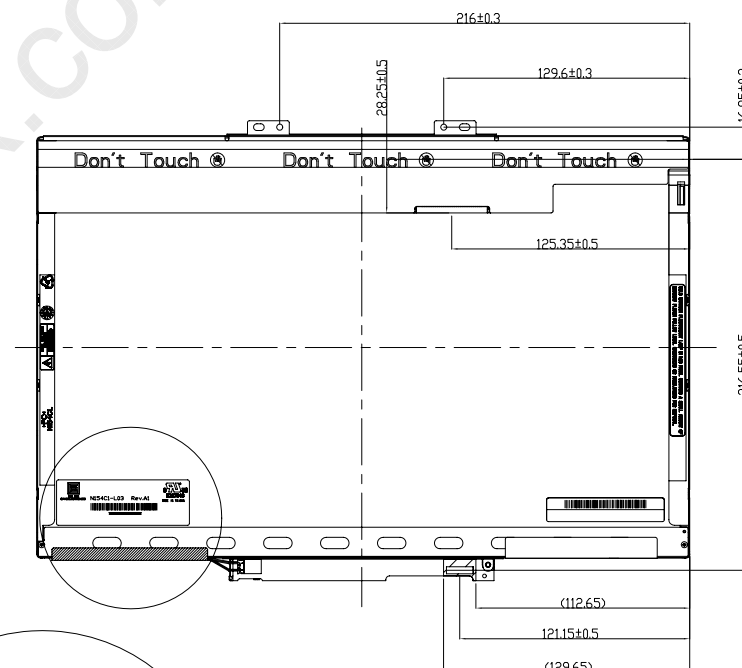
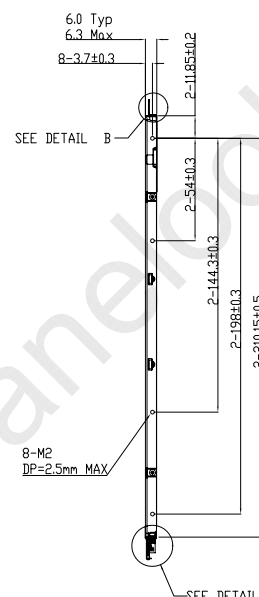
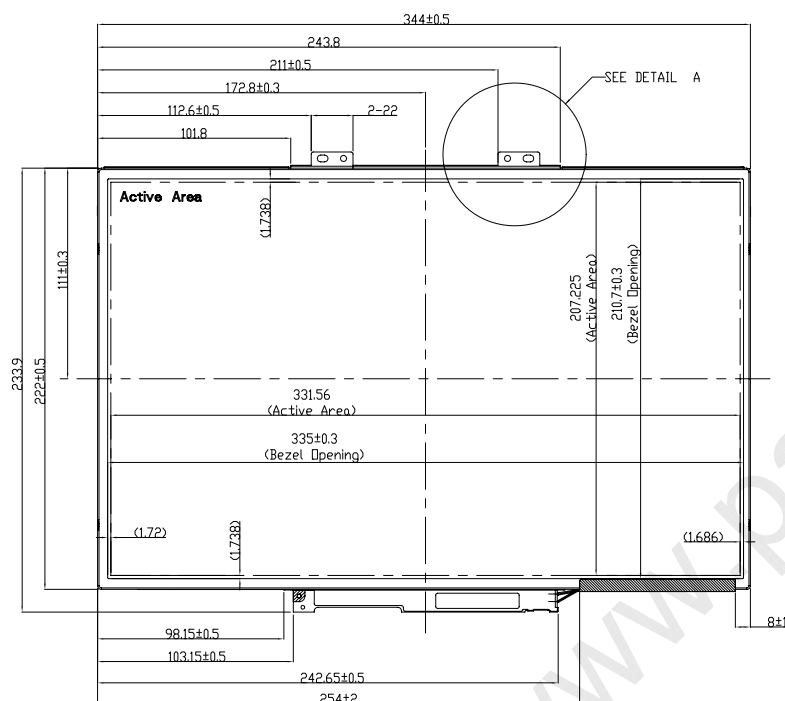
DETAIL B  
SCALE 4:1



DETAIL C  
SCALE 4:1

## NOTE:

- 1.GENERAL TOLERANCE :  $\pm 0.5$  mm.
- 2.THE SCREW TORQUE FOR MOUNTING SHALL NOT EXCEED 2.0 kgf-cm (0.196 N-m).
- 3."\*" MARKS THE DESIGN CRITICAL DIMENSION.
- 4."Ⓟ" MARKS THE PROCESS CRITICAL DIMENSION.
- 5.SIGNAL INTERFACE CONNECTOR: FI-XB30SRL-HF11 (JAE).
- 6.CCFL CONNECTOR : BHSR-02VS-1 (JST).



DETAIL A  
SCALE 2:1

| Mark | Description | Date | Changed_By | Approved_By | ECN No. | Remark |
|------|-------------|------|------------|-------------|---------|--------|
|      |             |      |            |             |         |        |
|      |             |      |            |             |         |        |

|                                   |                        |                                         |
|-----------------------------------|------------------------|-----------------------------------------|
| TITLE: Outline Drawing N154C1-L03 |                        | REV: 1                                  |
| Approved: [Signature]             | Drawing No: N154C1-L03 | REV: 1                                  |
| Checked: [Signature]              | Part No: None          |                                         |
| Drawn: [Signature]                | Material: T00          | Sheet 1 / 1                             |
| Designer: [Signature]             | Date: 18-Jan-2006      | Scale: 1:1                              |
| CHI MEI OPTOELECTRONICS CORP.     |                        | ALL RIGHTS RESERVED. COPYING FORBIDDEN. |